



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
25.07.2001 Bulletin 2001/30

(51) Int Cl.7: **C23C 16/44**, C23C 14/22,
H01L 21/00, C23C 16/26,
C23C 14/06

(43) Date of publication A2:
08.12.1999 Bulletin 1999/49

(21) Application number: **99301697.1**

(22) Date of filing: **08.03.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **01.06.1998 US 88456**

(71) Applicants:
• **Sharp Kabushiki Kaisha**
Osaka-shi, Osaka 545-8522 (JP)
• **SHARP MICROELECTRONICS TECHNOLOGY,
INC.**
Camas, WA 98607 (US)

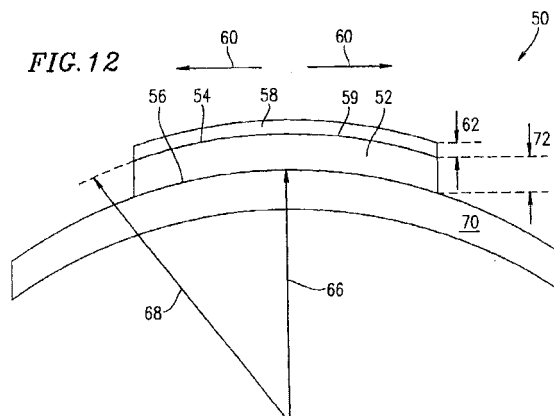
(72) Inventors:
• **Hsu, Sheng Teng**
Camas, WA 98607 (US)
• **Yang, Hongning**
Vancouver, WA 98683 (US)
• **Evans, David R.**
Beaverton, OR 97007 (US)
• **Nguyen, Tue**
Vancouver, WA 98683 (US)
• **Ma, Yanjun**
Vancouver, WA 98683 (US)

(74) Representative: **Brown, Kenneth Richard et al**
R.G.C. Jenkins & Co.
26 Caxton Street
London SW1H 0RJ (GB)

(54) **Method for deposition of a stressed film**

(57) A method has been provided to counteract the inherent tension in a deposited film. A wafer (50) substrate is fixed to a wafer chuck (70) having a curved surface (56). When the chuck surface is convex, a tensile stress is implanted in a deposited film (58). Upon release from the chuck, the deposited film develops a compressive stress. When the chuck surface is concave, a compressive stress is implanted in the deposited

film. Upon release from the chuck, the deposited film develops a tensile stress. Loading a film with a compressive stress is helpful in making films having an inherently tensile stress become thermal stable. Stress loading is also used to improve adhesion between films, and to prevent warping of a film during annealing. A product-by-process using the above-described method is also provided.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 1697

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|---|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| X | PATENT ABSTRACTS OF JAPAN vol. 018, no. 468 (C-1244), 31 August 1994 (1994-08-31) & JP 06 145964 A (SHARP CORP), 27 May 1994 (1994-05-27) | 1,2,4,6, 16-20, 22-26, 28-32,53 | C23C16/44 C23C14/22 H01L21/00 C23C16/26 C23C14/06 |
| Y | * abstract * | 5,21, 34-37 | |
| | --- | | |
| X | US 5 674 599 A (YAMADA KATSUYUKI) 7 October 1997 (1997-10-07) | 1,6,33, 42-47,52 | |
| Y | * column 2, line 58 - column 3, line 67 * * column 9, line 58 - column 10, line 18 * | 34-37 | |
| | --- | | |
| X | US 5 738 729 A (DUBS MARTIN) 14 April 1998 (1998-04-14) * column 6, line 10 - line 52 * | 1-3,6,11 | |
| | --- | | |
| X | US 5 620 745 A (SIMPSON MATTHEW A) 15 April 1997 (1997-04-15) * column 3, line 39 - line 46 * | 1,17,27 | |
| | --- | | |
| X | PATENT ABSTRACTS OF JAPAN vol. 1995, no. 01, 28 February 1995 (1995-02-28) & JP 06 280026 A (SEMICONDUCTOR ENERGY LAB CO LTD), 4 October 1994 (1994-10-04) | 1,17 | TECHNICAL FIELDS SEARCHED (Int.Cl.6) C23C |
| Y | * abstract * & US 5 879 741 A (K. ITOH) 9 March 1999 (1999-03-09) * example 1 * | 5,21 | |
| | --- | | |
| X | PATENT ABSTRACTS OF JAPAN vol. 014, no. 078 (P-1006), 14 February 1990 (1990-02-14) & JP 01 292645 A (CANON INC), 24 November 1989 (1989-11-24) * abstract * | 1-3 | |
| | --- | | |
| | -/-- | | |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 30 May 2001 | Examiner Ekhult, H |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | |

EPC FORM 1503 03.92 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 1697

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|--|--|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| A | ANONYMOUS: "ENHANCED Tc OF FILMS OF La-Ba-Cu-O TYPE COMPOUNDS" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 32, no. 1, 1 June 1989 (1989-06-01), page 68 XP002167797 New York, US * the whole document * | 7-10, 12-15, 38-41 | |
| A | US 5 695 566 A (FUKUI SHOJI ET AL) 9 December 1997 (1997-12-09) * column 4, line 25 - column 6, line 41 * | 1-53 | |
| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.6) |
| | | | |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 30 May 2001 | Examiner Ekhult, H |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p> | | | |

EPF FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 1697

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-05-2001

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|--|--|
| JP 06145964 A | 27-05-1994 | NONE | |
| US 5674599 A | 07-10-1997 | JP 5313210 A | 26-11-1993 |
| US 5738729 A | 14-04-1998 | WO 9718342 A DE 29601288 U | 22-05-1997 20-06-1996 |
| US 5620745 A | 15-04-1997 | CA 2190231 A EP 0780489 A JP 9169596 A | 20-06-1997 25-06-1997 30-06-1997 |
| JP 06280026 A | 04-10-1994 | US 5879741 A | 09-03-1999 |
| JP 01292645 A | 24-11-1989 | JP 2571819 B | 16-01-1997 |
| US 5695566 A | 09-12-1997 | JP 8316215 A CN 1138746 A KR 212228 B | 29-11-1996 25-12-1996 02-08-1999 |